

CLAIMS:

1. Optical disc apparatus (1; 125) for recording and/or reproducing information from an information surface (3; 129) of a rotatable optical disc (5; 127), comprising:

- a supporting assembly (7; 131);

- a motor (9; 133), associated with the supporting assembly (7; 131), for rotating the optical disc (5; 127) about a spindle axis (13; 134) and having a magnetic rotor (15) and a magnetic motor stator (17) magnetically cooperating with each other across an intermediate air gap (19);

- optical means associated with the supporting assembly (7; 131) for scanning an information surface (3; 129) of said optical disc (5; 127) and comprising a focusing lens assembly (29, 33; 139, 141) having a movable focusing lens (29; 139) having a focusing axis (35; 143), said focusing lens assembly (29, 33; 139, 141) being movable in an axial direction along said focusing axis (35; 143) for focusing an optical beam (42) on said information surface (3; 129) of said optical disc (5; 127);

- a swing arm assembly (41; 135) comprising a generally elongated swing arm structure (43; 137) mounting said focusing lens assembly (29, 33; 139, 141) near a free end (45; 203), the swing arm assembly (41; 135) being pivotally rotationally movable about a swing axis (47; 145) remote from said free end (45; 203) and directed generally perpendicularly to the swing arm structure (43; 137) and generally parallel to said spindle axis (13; 134) and said focusing axis (35; 143), such that the swing arm assembly (41; 135) rotationally sweeps a scanning plane generally parallel to said information surface (3; 129) of the mounted optical disc (5; 127), the swing arm assembly thereby causing said focusing lens assembly (29, 33; 139, 141) to scan over the information surface (3; 129) of a mounted optical disc (5; 127);

- rotational pivoting means (49, 51, 53; 149, 151, 153) for enabling said rotational scanning movements of the swing arm assembly (41; 135) and comprising stationary pivoting means (49; 153) associated with the supporting assembly (7; 131) and movable pivoting means (51, 53; 149, 151) associated with the swing arm structure (43; 137) pivotally cooperating with the stationary pivoting means (49; 153);

- movable magnetic scanning means (55, 57; 155) provided at the free end (45; 203) of the swing arm assembly (41; 135) for driving said swing arm assembly (41; 135) rotationally about said swing axis (47; 145);

- stationary magnetic scanning means (59, 75, 77; 207, 209, 211) associated with the supporting assembly (7; 131) and comprising a magnetic scanning stator core (59; 207) provided near and spaced from the free end (45; 203) of the swing arm assembly (41; 135) for magnetically cooperating with said movable magnetic scanning means (55, 57; 157) across at least one intermediate air gap (61) disposed in a curved plane (63);

wherein the stationary magnetic scanning means (59, 75, 77; 207, 209, 211) are rigidly associated with the magnetic motor stator (17; 133).

2. Optical disc apparatus (1; 125) according to claim 1, wherein the motor stator (17; 133) and the scanning stator core (59; 209) are integrated into a combined stationary unit (17, 59; 133, 209).

3. Optical disc apparatus (1; 125) according to claim 1 or 2, wherein also the stationary pivoting means (49; 153) are rigidly associated with the magnetic motor stator (17; 133).

4. Optical disc apparatus (1; 125) according to claim 2 and 3, wherein the motor stator (17; 133), the scanning stator core (59; 209) and the stationary pivoting means (49; 153) are integrated into a combined stationary unit (17, 49, 59; 133, 153, 209).

5. Optical disc apparatus (1; 125) according to any of claims 1 to 4, wherein the optical disc apparatus further comprises:

- focusing guide means for enabling the axial focusing movements of the focusing lens assembly (29, 33; 139, 144) along said focusing axis (35; 143);

- movable magnetic focusing means (55, 57; 179A,B) provided at the free end (45; 203) of the swing arm assembly (41; 135) for axially driving said focusing lens assembly (29, 33; 139, 141) along said focusing axis for focusing an optical beam on the disc information surface (3; 129);

- stationary magnetic focusing means (75, 77; 207) associated with the supporting assembly (7; 131) and comprising a magnetic focusing stator core (59; 209) provided near and spaced away from the free end (45; 203) of the swing arm assembly (41;

135) for magnetically cooperating with the said movable magnetic focusing means (55, 57; 179A,B) across at least one intermediate air gap (61) disposed in a curved plane (63);

wherein the stationary magnetic focusing means (75, 77; 207) are rigidly associated with the magnetic motor stator (17; 133).

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6. Optical disc apparatus (1; 125) according to claims 4 and 5, wherein the motor stator (17; 133), the scanning stator core (59; 209), the stationary pivoting means (49; 153) and the focusing stator core (59; 209) are integrated into a combined stationary unit (17, 49, 59; 133, 153, 209).

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7. Optical disc apparatus (1; 125) according to any of claims 2-4 or 6, wherein the combined stationary unit (17, 49, 59; 133, 153, 209) comprises a stator packet assembled from magnetizable individual stator laminations (69, 71, 73).

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8. Optical disc apparatus (1) according to claim 7, wherein:

- the movable magnetic scanning means comprise permanent magnetic rotationally movable scanning means (55, 57),

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- the stationary magnetic scanning means comprise a number of individual stator coils (75, 77) arranged on the stator core (59) in a serial arrangement along the rotational scanning path (63) of the movable permanent magnetic scanning means (55, 57),

- electronic commutating means (115) being provided to selectively switch stator coils (75, 77) on and off,

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- scanning sensor means (79) being provided for detecting, and scanning control means being provided for controlling the rotational position of the arm structure (43) respectively, by controlling the current amplitude and direction in each of the stator coils (75, 77) which has been selectively switched on in order to control the rotational arm position and movements.

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9. Optical disc apparatus (1) according to claim 8, wherein:

- the movable magnetic focusing means comprise permanent magnetic axially movable focusing means (55, 57) and

- the stationary magnetic scanning means and the stationary magnetic focusing means comprise a number of individual stator coils (75, 77) arranged on the stator core (59)

in a serial arrangement along the rotational scanning path (63) of the movable permanent magnetic scanning means (55, 57) and distributed over two axially spaced levels,

- focusing sensor means being provided for detecting, and focusing control means being provided for controlling the axial focusing lens position respectively by

5 controlling the current amplitude and direction in each of the stator coils (75, 77) which have been selectively switched on in order to control the axial focusing lens (33) position and movements.

10. Optical disc apparatus (1) according to claim 9, wherein:

10 - the stator coils (75, 77) in each of the two levels are spaced at a constant pitch on the stator core (59) along the path (63) rotationally swept by the movable magnetic scanning means (55, 57) and movable magnetic focusing means (55, 57),

- the stator coils (75, 77) in the two levels are arranged in planes parallel to the scanning plane of the scanning arm structure (43) and

15 - the stator coils (75) present in one level are positioned between the stator coils (77) present in the other level.

11. Optical disc apparatus (1) according to any of claims 8-10 , wherein biasing means (99; 55, 57, 105, 107) are provided to bias the magnetic force of attraction produced
20 between the movable permanent magnetic scanning and/or focusing means (55, 57) and the motor stator (17), magnetic adhesion of the scanning arm structure (43) to the motor stator (17) being prevented in a rotationally extreme position of the scanning arm structure (43) nearest to the spindle motor.

25 12. Optical disc apparatus (1) according to claim 11, wherein:

- the stator core (59) is provided with stator teeth,

- the stator coils (75, 77) are wound on the stator teeth (105, 107) and

- the biasing means are provided by one or more stator teeth (105, 107) on said stator core (59), positioned such that in said extreme rotational position of the scanning arm
30 structure the rotational magnetic pull (P) of said one or more stator teeth (105, 107) exceeds the rotational magnetic pull of the motor stator (17).

13. Optical disc apparatus (125) according to any of claims 1-7 , wherein:

- the movable magnetic scanning means comprise a cylindrical scanning coil (155) having a generally rectangular shape in cross section and having a central opening (157), two pairs of parallel outer side surfaces (159, 161-163, 165), two pairs of inner side surfaces (167, 169-171, 173) and outwardly facing axial end surfaces (175, 177) at the axially spaced ends of the coil (155),

- the movable focusing means comprising two cylindrical focusing coils (179 A,B) which have a generally rectangular shape in cross-section and have a central opening (181), two pairs of parallel outer side surfaces (183, 185-187, 189), two pairs of inner side surfaces (191, 193-195, 197) and outwardly facing axial end surfaces (199, 201) at the axially spaced ends of the coil (179 A,B),

- the scanning coil (155) being bonded with one of its outer side surfaces to the free end (203) of the swing arm structure (137) in a position with its central axis (205) generally parallel to the scanning movements of the swing arm,

- each focusing coil (179 A,B) being bonded at a part of one of its outwardly facing axial end surfaces (199) on one side of its central opening (181) against the outer side surface (161) of the scanning coil (155) which is remote from the swing arm structure (137), the two focusing coils (179 A,B) being disposed such that said parts of their outwardly facing axial end surfaces (159) are near to each other, parallel to each other and generally parallel to the scanning movements of the swing arm,

- the combined stationary magnetic means comprising an elongated permanent-magnet means (207) facing the movable focusing coils (179 A,B) and spaced from the focusing coils (179 A,B) by said air gap, and further comprising a magnetically permeable stator (209) supporting the permanent-magnet means (207) and having a stator part (211) passing through the central opening (157) of the scanning coil (155) with play, the permanent magnet means (207) being magnetically polarized in a radial direction relative to the swing axis (145) of the swing arm assembly (135) and the arrangement being such that a substantially radially directed permanent magnetic field is set up across said air gap.